form cell-phone energy detection algorithm, and send information to computer **16** via the Ethernet.

The hardware down-converts received RF signals to an IF frequency. It is capable of being configured in any of the cell phone bands in the U.S. by replacing RF filters (which are located in line with the receive antennae **20**), and by providing a suitable local oscillator frequency (provided by a flexible signal generator in the current design).

Extensive testing consisted of transmitting with a modem for the selected locations within each room (**1-20**) of building **12**. The average localization accuracy (percentage of identifying the correct room and the source of the wireless signal) for varying numbers of detecting signals and a number of positions in each room as calibration data is as shown in Table 1.

TABLE 1

Average location accuracy.			
Number of	Number of sampled positions in each office		
received signals	4	15	15
~30	50%	x	x
1-3	x	60%	60%
10	x	x	80%

Localization was deemed accurate if the software determined location of the transmitter within a neighborhood of three neighboring rooms (i.e., a transmission from room **8** is accurate if deemed to be from room **7**, **8** or **9**). It was found that sampling **15** positions in each room, and detecting the signal ten times, enabled predicting the neighborhood of the transmitter correctly in 80% of the time on average.

FIG. **3** is a bar graph showing the success rate in identifying usage from the room or a neighboring room for seven different rooms (room numbers **6-13**) in building **12**. It is believed the lower success rate for room **13** is due to the fact its neighbors are not included in the test. Multiple testing in different rooms has shown similar results. It should be noted that classification accuracy is not affected significantly if calibration data taken from some time ago (two months) is used to classify signals detected currently. Accordingly, the system has shown accuracy of ±1 rooms/cells using recordings obtained over approximately three minutes of cell phone use.

While the invention has been taught with specific reference to these embodiments, one skilled in the art will recognize that changes can be made in form and detail without departing from the spirit and scope of the invention.

The invention claimed is:

1. A device for detecting wireless signals and locating the place of origin in a building, comprising:

a transmitter system using a cellular protocol;

a plurality of antennae that receive wireless Radio Frequency (RF) signals, each antenna having a port and one antennae is denoted as a reference antenna;

a receiving system connected to the antennae ports with a plurality of cables, converting the RF signal to voltage waveform;

a processing system in communication with the receiving system, detecting the strength of the received signals and Time Difference of Arrival of the RF signals with respect to antennae and determining the location where the wireless signals are being emitted by using classification algorithms, the processing system including preprocessing software that filters voltage signals and determines features of the voltage signals including signal strength and Time Difference of Arrival to the antennae with respect to the referenced antennae; and

a human machine interface.

2. The device of claim **1**, wherein the transmitter system is a modem(s) programmed through a computer to send out RF signals to provide training data sequences to the processing system.

3. The device of claim **1**, wherein the receiving system has four channels and samples the RF signals and converts them to voltage using aliasing and band pass filtering.

4. The device of claim **1**, further comprising communication means between the receiving system and processing system.

5. The device of claim **3**, wherein the communication means is implemented using Gigabit Ethernet.

6. The device of claim **3**, wherein the processing system consists of a computer and signal processing software.

7. The device of claim **6**, wherein the signal processing software further includes classification software.

8. The device of claim **7**, in which training data sequences are used to provide statistical information of features of voltage signal.

9. The device of claim **7**, in which a supervised classification algorithm determines the location in which usage of the wireless device occurred.

10. The device of claim **1**, in which a human machine interface sets an alarm and provides an operator with visual information of the location in which the wireless device has been used.

11. The method for detecting wireless singles and locating the place of origin in the building as set forth in claim **1**, further including the step of providing indication means implemented using Gigabit Ethernet.

12. A method for detecting wireless singles and locating the place of origin in a building, comprising the steps of:

providing a transmitter system that utilizes a cellular protocol;

providing a plurality of antennae that receive Radio Frequency (RF) signals, each antenna having a port;

placing the antennae at different locations spread throughout the building;

providing a receiving system connected to the antennae ports;

converting the RF signal to voltage waveform;

providing a processing system in communication with the receiving system;

detecting the strength of the received signals and Time Difference of Arrival of the RF signals with respect to the antennae;

determining the location where the wireless signals are being omitted by utilizing classification algorithms;

providing signal processing software including preprocessing software, filtering voltage signals through the preprocessing software, and determining features of voltage signals including signal strength and Time Difference of Arrival to the antennae with respect to a referenced antennae; and

providing a human machine interface.

13. The method for detecting wireless signals and locating the place of origin in the building as set forth in claim **12**, wherein the transmitter system is a modem(s) programmed through a computer, and further including the step of sending out RF signals to provide training data sequences to the processing system.